For all questions, "NOTA" means none of the above answers is correct.

1. If $\left(\dfrac{1}{2}\right)^{-\frac{1}{m}} = 4^{\frac{2}{3}}$, then find the value of m.

    A. $-\dfrac{4}{3}$ B. $-\dfrac{3}{4}$ C. $-\dfrac{2}{3}$ D. $\dfrac{3}{4}$ E. NOTA

2. Simplify the expression $\dfrac{(n+1)!}{(n-2)!n}$ for $n > 2$.

    A. n^2 B. $(n-1)^2$ C. $n-1$ D. $n^2 - 1$ E. NOTA

3. Find the constant term in the expansion of $\left(y^2 + \dfrac{1}{y^2}\right)^{10}$.

    A. 1   B. 210   C. 252   D. 630   E. NOTA

4. Find the value of $x + y$ for $\dfrac{1}{729}\left(3^{2x}\right) = 9\left(9^y\right)$ and $\dfrac{1}{4}\left(16^x\right) = 16\left(8^{-2y}\right)$.

    A. –2   B. $-\dfrac{2}{3}$ C. 1   D. 2   E. NOTA

5. According to Newton's Law of Cooling, when the difference in the temperature of a warm object and its cooler surroundings is measured at equal time intervals, the differences form a geometric sequence. If the temperature of a piece of toast was $26°C$ at 8:00 a.m. and $22°C$ at 8:10 a.m., what was its temperature when the toast was taken out of the toaster at 7:40 a.m.? Assume the air temperature remained constant at $20°C$.

    A. $30°C$ B. $50°C$ C. $62°C$ D. $74°C$ E. NOTA

6. $i = \sqrt{-1}$, $\dfrac{1}{(1+i)^4} + \dfrac{1}{(1-i)^3} = a + bi$, where a and b are real numbers. Find the value of b.

    A. $\dfrac{1}{2}$ B. $\dfrac{i}{2}$ C. $-\dfrac{1}{4} + \dfrac{i}{4}$ D. $\dfrac{1}{4}$ E. NOTA

7. If the sum of the measures of the interior angles of a regular polygon is 2160, find the number of diagonals of the polygon.

    A. 66   B. 77   C. 132   D. 154   E. NOTA

8. Give the simplified form of $\dfrac{2^{n+1} - 2^{n-1}}{2^{2n} - 2^{2n-2}}$, where defined.

    A. 2^{1-n} B. $\dfrac{1}{2^n}$ C. $2^{1-n} + 2^{1-n}$ D. $\dfrac{3}{2^{n-1}}$ E. NOTA
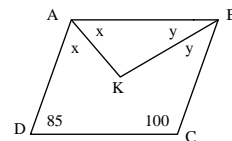
9. $P(x) = x^3 - 6x^2 + Bx + C$ has $1 + 5i$ as a zero and B and C are real numbers. Find $B + C$.

    A. -70 B. 4   C. 24   D. 138   E. NOTA

10. What is the 7th entry in the 12th row of Pascal's triangle where the first row contains only a 1?

    A. 210   B. 462   C. 792   D. 1078   E. NOTA

11. Using the diagram, two consecutive angles of a quadrilateral are $85°$ and $100°$. Find the degree measure of $\angle AKB$.

    A. 90   B. 92 ½   C. 93 ½   D. 100   E. NOTA

12. In right $\triangle ABC$, $\overline{BD}$ is the altitude to the hypotenuse $\overline{AC}$, $AB = 20, BD = 16$.
Find the length of $\overline{AC}$.

    A. $\dfrac{8}{3}$ B. $\dfrac{44}{3}$ C. $\dfrac{64}{3}$ D. $\dfrac{100}{3}$ E. NOTA

13. $\begin{bmatrix} -1 & 3 \\ 4 & 2 \end{bmatrix}^{-1} \bullet \begin{bmatrix} 1 & -1 \\ 0 & 2 \end{bmatrix} =$

    A. $\begin{bmatrix} 2 & -4 \\ -8 & 2 \end{bmatrix}$ B. $\begin{bmatrix} -\dfrac{1}{7} & \dfrac{2}{7} \\ \dfrac{4}{7} & -\dfrac{1}{7} \end{bmatrix}$ C. $\begin{bmatrix} 2 & -8 \\ -4 & 2 \end{bmatrix}$ D. $\begin{bmatrix} -\dfrac{1}{7} & \dfrac{4}{7} \\ \dfrac{2}{7} & -\dfrac{1}{7} \end{bmatrix}$ E. NOTA

14. Given: $P(x) = x^4 + x^2 - 7$. If $P(x)$ is divided by $x - 2$, the remainder is

    A. -7 B. 1   C. $P(2)$ D. $P(-2)$ E. NOTA

15. Give the equation for the linear function that passes through $(3, -8)$ and
is perpendicular to the graph of $y = \dfrac{x}{3} - \dfrac{5}{7}$.

    A. $f(x) = -3x + 1$ B. $f(x) = \dfrac{x}{3} - 9$

    C. $f(x) = -\dfrac{x}{3} - 7$ D. $f(x) = -3x - 1$ E. NOTA

16. The domain of the function $f(x) = \dfrac{\sqrt{x+2}}{x^2 - 9}$ is

    A. $(-\infty, -3) \cup [-2, \infty)$ B. $[2, 3)$

    C. $[-2, 3) \cup (3, \infty)$ D. Reals, $x \neq \pm 3$ E. NOTA

17. Let the roots of $\log_8(x^2-1) - \log_8(7x-11) = 0$ be represented by r and s.

     Find the value of $\left|r^2 - s^2\right|$.

       A. 4   B. 19   C. 21   D. 25   E. NOTA

18. If Cramer's Rule is used to solve the system $\begin{cases} 3x - 5y + 2z = -7 \\ x + 2y - 4z = 16 \\ 2x - y - z = 14 \end{cases}$, find the value of the numerator

     determinant when solving for y.

       A. 11   B. 55   C. 108   D. 133   E. NOTA

19. Give the sum of the roots of: $\dfrac{3-2x}{\sqrt{2x-3}} = \sqrt{2x} - 2$.

       A. $-\dfrac{25}{8}$ B. $-\dfrac{7}{8}$ C. $\dfrac{5}{8}$ D. $\dfrac{13}{8}$ E. NOTA

20. Find the circumference of the circle $x^2 + y^2 + 9x - 8y + 4 = 0$.

       A. $\dfrac{129}{4}\pi$ B. $\dfrac{129}{2}\pi$ C. $\sqrt{21}\pi$ D. $\sqrt{29}\pi$ E. NOTA

21. Find the focus of the parabola $(x+3)^2 = 8(y-2)$.

       A. $(-3,2)$ B. $(-5,2)$ C. $(-3,4)$ D. $(-1,2)$ E. NOTA

22. In rectangle ABCD with point E on $\overline{AB}$, $BC = BE, AE = 7, EC = 5\sqrt{2}$.
     Find the ratio of the area of $\triangle CBE$ to the area of trapezoid $AECD$.

       A. $\dfrac{5}{38}$ B. $\dfrac{5}{19}$ C. $\dfrac{10}{19}$ D. $\dfrac{24}{19}$ E. NOTA

23. Given the triangle whose vertices are $A(-3,2), B(5,6),$ and $C(1,-4)$, find the

     equation of the altitude from A to $\overleftrightarrow{BC}$.

       A. $x - 2y = 9$ B. $5x + 2y = 11$ C. $5x - 2y = -19$ D. $2x + 5y = 4$ E. NOTA

24. Find the value of $\log_{128} 8 - \log_2 0.25 + \log_3 \dfrac{1}{81} + \log_9 \sqrt{27}$.

       A. $-\dfrac{3}{8}$ B. $-\dfrac{23}{28}$ C. $\dfrac{15}{28}$ D. $\dfrac{201}{28}$ E. NOTA

25. Solve for x: $4y - x - 3xy \leq 0$, $y \geq -\dfrac{1}{3}$.

    A. $x \leq \dfrac{4y}{1+3y}$ B. $x \geq \dfrac{4y}{1-3y}$ C. $x \geq \dfrac{4}{1+3y}$ D. $x \leq \dfrac{4y}{1-3y}$ E. NOTA

26. Give the simplest form of : $\left(\sqrt[3]{3} - \sqrt[3]{5}\right)\left(\sqrt[3]{9} + \sqrt[3]{15} + \sqrt[3]{25}\right)$.

    A. 2   B. $2 - \sqrt[3]{3}$ C. $\sqrt[3]{5} - 3$ D. $3\sqrt[3]{5} - 2$ E. NOTA

27. The bottom, side and front areas of a rectangular box are known. The numerical product of these areas (discounting units) is equal to which value below?

    A. volume of the box   B. square root of the volume of the box
    C. twice the volume of the box   D. square of the volume of the box
    E. NOTA

28. If $(x+y)^2 = 90$ and $(x-y)^2 = 30$, find the value of $x^2 - xy + y^2$.

    A. 30   B. 35   C. 40   D. 45   E. NOTA

29. The letters of the word QUIET are rearranged at random. What is the probability that Q and U will be together in either order?

    A. $\dfrac{1}{6}$ B. $\dfrac{1}{5}$ C. $\dfrac{2}{5}$ D. $\dfrac{2}{3}$ E. NOTA

30. How many of the following statements must be true for the ellipse with equation $16x^2 + 9y^2 - 96x + 72y + 144 = 0$?

    I.   Center is (3, 4)

    II.   Eccentricity is $\dfrac{\sqrt{7}}{3}$

    III.   Major axis has length 8.

    IV.   (3, 0) is a vertex.

    V.   The area is 12π.

    A. 2   B. 3   C. 4   D. 5 E. NOTA